Model 9139A-PCA
Probe Card Adapter

Instruction Manual

9139A-901-01 Rev. D / October 2011

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Model 9139A-PCA Probe Card Adapter
Instruction Manual

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KEITHLEY

Safety Precautions

The following safety precautions should be observed before using this product and any associated instrumentation. Although some instruments and accessories would normally be used with non-hazardous voltages, there are situations where hazardous conditions may be present.

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product. Refer to the user documentation for complete product specifications.

If the product is used in a manner not specified, the protection provided by the product warranty may be impaired.

The types of product users are:

Responsible body is the individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring that operators are adequately trained.

Operators use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument. They must be protected from electric shock and contact with hazardous live circuits.

Maintenance personnel perform routine procedures on the product to keep it operating properly, for example, setting the line voltage or replacing consumable materials. Maintenance procedures are described in the user documentation. The procedures explicitly state if the operator may perform them. Otherwise, they should be performed only by service personnel.

Service personnel are trained to work on live circuits, perform safe installations, and repair products. Only properly trained service personnel may perform installation and service procedures.

Keithley Instruments products are designed for use with electrical signals that are rated Measurement Category I and Measurement Category II, as described in the International Electrotechnical Commission (IEC) Standard IEC 60664. Most measurement, control, and data I/O signals are Measurement Category I and must not be directly connected to mains voltage or to voltage sources with high transient over-voltages. Measurement Category II connections require protection for high transient over-voltages often associated with local AC mains connections. Assume all measurement, control, and data I/O connections are for connection to Category I sources unless otherwise marked or described in the user documentation.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30V RMS, 42.4V peak, or 60VDC are present. A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.

Operators of this product must be protected from electric shock at all times. The responsible body must ensure that operators are prevented access and/or insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product operators in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000V, no conductive part of the circuit may be exposed.

Do not connect switching cards directly to unlimited power circuits. They are intended to be used with impedance-limited sources. NEVER connect switching cards directly to AC mains. When connecting sources to switching cards, install protective devices to limit fault current and voltage to the card.

Before operating an instrument, ensure that the line cord is connected to a properly-grounded power receptacle. Inspect the connecting cables, test leads, and jumpers for possible wear, cracks, or breaks before each use.

When installing equipment where access to the main power cord is restricted, such as rack mounting, a separate main input power disconnect device must be provided in close proximity to the equipment and within easy reach of the operator.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under test. ALWAYS remove power from the entire test system and discharge any capacitors before: connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.

The instrument and accessories must be used in accordance with its specifications and operating instructions, or the safety of the equipment may be impaired.

Do not exceed the maximum signal levels of the instruments and accessories, as defined in the specifications and operating information, and as shown on the instrument or test fixture panels, or switching card.

When fuses are used in a product, replace with the same type and rating for continued protection against fire hazard.

Chassis connections must only be used as shield connections for measuring circuits, NOT as safety earth ground connections.

If you are using a test fixture, keep the lid closed while power is applied to the device under test. Safe operation requires the use of a lid interlock.

If a screw is present, connect it to safety earth ground using the wire recommended in the user documentation.

The symbol on an instrument means caution, risk of danger. The user should refer to the operating instructions located in the user documentation in all cases where the symbol is marked on the instrument.

The symbol on an instrument means caution, risk of danger. Use standard safety precautions to avoid personal contact with these voltages.

The symbol on an instrument shows that the surface may be hot. Avoid personal contact to prevent burns.

The symbol indicates a connection terminal to the equipment frame.

If this symbol is on a product, it indicates that mercury is present in the display lamp. Please note that the lamp must be properly disposed of according to federal, state, and local laws.

The **WARNING** heading in the user documentation explains dangers that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **CAUTION** heading in the user documentation explains hazards that could damage the instrument. Such damage may invalidate the warranty.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

To maintain protection from electric shock and fire, replacement components in mains circuits - including the power transformer, test leads, and input jacks - must be purchased from Keithley Instruments. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. Other components that are not safety-related may be purchased from other suppliers as long as they are equivalent to the original component (note that selected parts should be purchased only through Keithley Instruments to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call a Keithley Instruments office for information.

To clean an instrument, use a damp cloth or mild, water-based cleaner. Clean the exterior of the instrument only. Do not apply cleaner directly to the instrument or allow liquids to enter or spill on the instrument. Products that consist of a circuit board with no case or chassis (e.g., a data acquisition board for installation into a computer) should never require cleaning if handled according to instructions. If the board becomes contaminated and operation is affected, the board should be returned to the factory for proper cleaning/servicing.

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1 General Information

1.1 Introduction

This section contains general information about the Model 9139A-PCA Probe Card Adapter. The probe card adapter is designed specifically for parametric testing. The advanced design of the probe card adapter provides greater accuracy of parametric tests where a wide range of measurements are needed.

The Model 9139A is a specially designed interface to connect a Keithley Parametric Tester to the device under test (DUT) while maintaining system specifications. Other applications with Keithley switching systems are possible on a custom order basis.

NOTE

Specific information about installing hardware on the prober is found in the documentation provided by the prober manufacturer.

Information about connections to the Keithley Parametric Test systems is found in the documentation provided with your system.

1.2 Features

Key features of the Model 9139A-PCA Probe Card Adapter include:

- Vacuum lock allows quick exchange of probe cards with accurate and repeatable alignment,
- Easy connection of DUT cables to probe card,
- Mother board accepts 64 DUT cables; probe card contains 64 fully guarded measure and sense lines,
- Maintains test system specifications to the probe tip,
- Preserves full Kelvin connections to probe tip,
- Extended guards (reduces capacitance),
- DUT cables can be routed vertically or horizontally to the motherboard, supporting many different probers,
- Extends low current capabilities of the Keithley Parametric Test system.

1.3 Manual addenda

Any improvements or changes concerning the probe card adapter or manual will be explained in an addendum included with the unit. Be sure to note these changes and incorporate them into the manual before using or servicing the unit.

1.4 Safety symbols and terms

The following safety symbols and terms may be found on the probe card adapter or used in this manual.

The symbol on an instrument indicates that the user should refer to the operating instructions located in the instruction manual.

The symbol on an instrument shows that high voltage may be present on the terminal(s). Use standard safety precautions to avoid personal contact with these voltages.

The **WARNING** heading used in this manual explains dangers that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **CAUTION** heading used in this manual explains hazards that could damage the probe card adapter. Such damage may invalidate the warranty.

1.5 Associated documents

The following associated documents are not included in this manual. They are included with the Keithley Parametric Test System and are recommended references.

- System installation guide — This guide provides general information about locations of components within the system cabinet. This guide also provides information about installing DUT cables, Instrument Cables and shorting plugs.
- Matrix manual — This manual provides detailed installation and operation instructions for the system matrix.
- The drawing set of your system — These drawings contain detailed information about the configuration of your system. The drawings show the DUT cable connections. Numbers located next to each DUT connection identify the pin number associated with the DUT connection.

1.6 Unpacking and inspection

1.6.1 Inspection for damage

CAUTION

Do not touch high impedance areas of the probe card assembly or the probe card. Touching a high impedance area will cause leakage and problems when performing low current measurements. Also, excessive leakage will cause the probe card adapter to fail system tests.

Carefully unpack your Model 9139A-PCA Probe Card Adapter from its original shipping carton and inspect the card for any obvious signs of physical damage. Report any such damage to the shipping agent immediately. Save the original packing carton for possible future shipment.

1.6.2 Shipment contents

The following items are included with every Model 9139A-PCA order:

- Model 9139A-PCA Probe Card Adapter
- Model 9139A-VUA Vacuum control box
- Unpopulated (blank) probe card (This probe card is used for diagnostics and is installed in the probe card adapter.)
- 15' (6 m) of 1/4” the vacuum hose
- Close Proximity Load Board with pin and sockets (optional)

1.6.3 Additional manuals

This manual is included with every order. If an additional manual is required, order the manual package (Keithley part number 9139A-901-00). The manual package includes an instruction manual and any pertinent addenda.

1.7 Packing for shipment

Should it become necessary to return the Model 9139A-PCA for repair, carefully pack the Model 9139A-PCA in its original packing carton (or equivalent) along with the following information:

- An RA (Return Authorization). Obtain the RA from the Semiconductor Business Unit Repair Department at Keithley. When an RA is issued, the Semiconductor Business Unit Administrator will also determine the warranty status of your probe card adapter.
- Advise as to the warranty status of the probe card adapter (received from the Semiconductor Business Unit Repair Department – see above).
- Write ATTENTION REPAIR DEPARTMENT on the shipping label.

2

Probe Card Adapter Overview

2.1 Introduction

This section contains an overview of the Model 9139A-PCA Probe Card Adapter.

2.2 Probe card adapter standard components

The Probe Card Adapter consists of the following parts (Figure 2-1):

- prober hardware,
- probe card adapter assembly consisting of:

  appropriate DUT cables,
  strain reliefs and other miscellaneous hardware,
  mother board containing interconnect pins for DUT cable connection,
  pogo pins and retention ring,
  light shield with interlock connection,
  prober ring,
  mother board support plate,
  insulation ring (Teflon),
  probe card ring,
  vacuum connection,
- probe card (without probe pins),
- close proximity load board (if needed for specific application of probe card adapter).

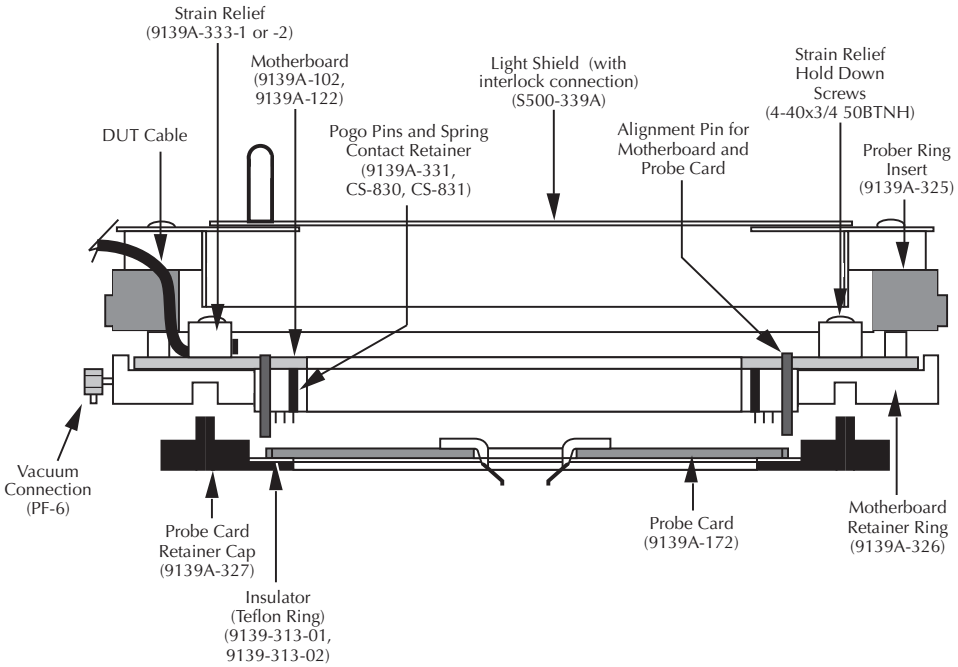

Figure 2-1
Probe and adapter components

2.3 Leakage paths and low current capabilities

The Model 9139A-PCA Probe Card Adapter permits fast low current measurements. The short length of the connections between the DUT cables and the probe pins reduces capacitive coupling between probe pins. Capacitance is further reduced by the extended guards. This reduced capacitance permits faster rise times.

The Model 9139A-PCA extends the low current capabilities of the Keithley Parametric Test system. Leakage is minimized by using short direct connections and by extending the guards traces through to the probe blade connections. Leakage paths are also minimized by using low leakage materials for the probe card and mother board.

2.4 Mother board characteristics

The mother board is the interface between the DUT cables and the probe card and it accepts 64 DUT cables. It is suspended from the prober mounting hardware. Source, measure, guard, and ground (where appropriate) are terminated for each DUT cable on the mother board. Source, measure, and guard signals are kept separate for each pin and are all carried down to the probe card through spring loaded contacts (pogo pins). Four ground pogo pins take ground down to the probe card. Source and measure lines are guarded on the mother board using state-of-the-art printed circuit board manufacturing techniques. DUT cables can be routed vertically or horizontally to the mother board. Vertical routing is used when the DUT cables are routed above the top platform (head plate) of the prober. Horizontal routing is used when the DUT cables are routed under the top platform of the prober.

2.5 Probe card configuration

The probe card contains 64 fully guarded measure and sense lines. It contains mounting traces for 64 probe needles. Drilled, plated-through holes are provided for interconnect pins. The interconnect pins provide connections to an optional close proximity load board. An unpopulated (blank) probe card is provided with the Probe Card Adapter Assembly. Additional blank probe cards are available through your Keithley sales representative.

NOTE

To reduce pin to pin capacitance, use ceramic blade probes.

2.6 Probe needle description

Although probe cards with mounted probe needles (pins) are not available through Keithley. Many probe card vendors are able to make probe cards for the 9139A. Make sure the probe card manufacturer complies with the probe needle specifications required by the Model 9139A (Figure 2-2 and Figure 2-3). Refer to Figure 2-3 for probe needle mounting information.

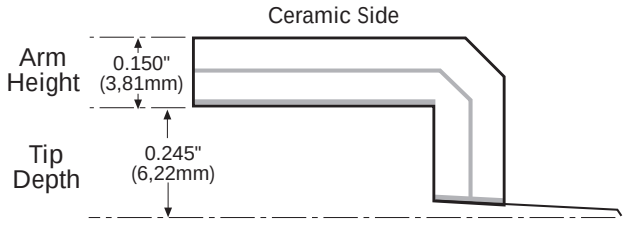

Figure 2-2
Probe needle dimensional specifications

2.7 Light shield

The light shield covers the opening in the center of the probe card adapter. This blocks ambient light and permits testing under a lights out condition.

2.8 Options

The following options are available with the Model 9139A-PCA Probe Card Adapter.

- Build Plate and Planarization fixture — Designed for mounting and adjusting probes on this probe card. The fixture interfaces to the Rucker & Kolls build station #300X and planarization station #425. This option is available from the facilities listed in Appendix B.
- Close proximity load board (and Hypertac™ pins and sockets) — Not required for most applications - used when external components are required at the DUT pin. The close proximity load board contains drilled, plated-through holes. Holes are provided for connections to source and measure of the DUT cable and for connections to the probe needles. A grid pattern of holes is provided to install components. Pin numbers are labeled on the board. This option is available directly from Keithley.

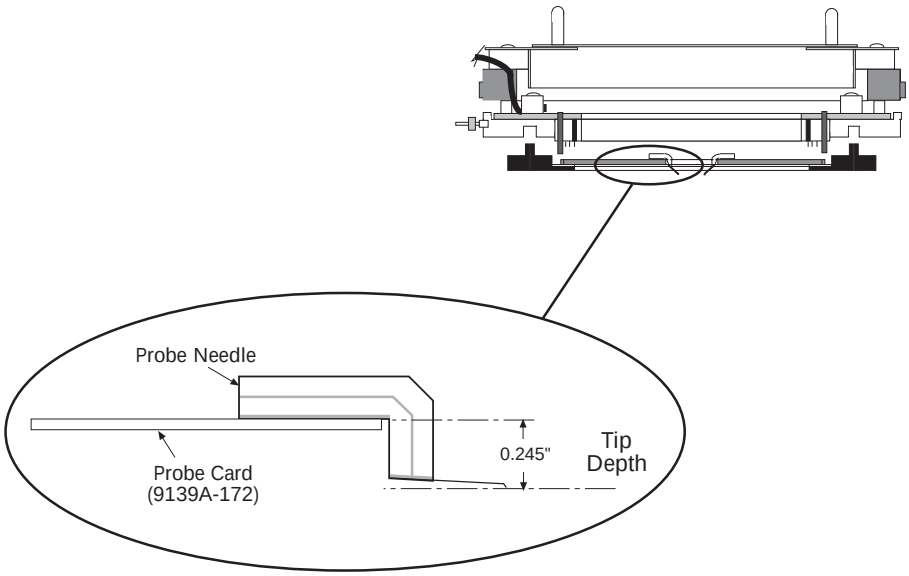

Figure 2-3
Probe needle mounting

3 Installation

3.1 Introduction

WARNING

The installation procedures contained in this manual are intended for use only by qualified service personnel. Do not perform these procedures unless qualified to do so. Failure to observe normal safety precautions could result in personal injury or death.

This section contains information needed for installing the Model 9139A-PCA Probe Card Adapter on your prober. Several paragraphs contain general installation steps. Other paragraphs contain installation steps required for your specific prober. Review the appropriate paragraph(s) before handling or installing the Model 9139A-PCA Probe Card Adapter.

3.2 Handling precautions

The Model 9139A Probe Card Adapter is assembled at the factory to provide the highest quality connections possible between the DUT and your system. Use care when handling these parts.

CAUTION

Do not touch high impedance areas of the probe card assembly or the probe card (Figure 3-1). Touching a high impedance area will cause leakage and problems when performing low current measurements. Also, excessive leakage will cause the probe card adapter to fail system tests.

Handle board only by the edges. Use gloves to prevent inadvertent contact with the high impedance areas (Figure 3-1). Avoid bringing the board into contact with sources of contamination. Always confirm that fixtures and handling equipment are clean.

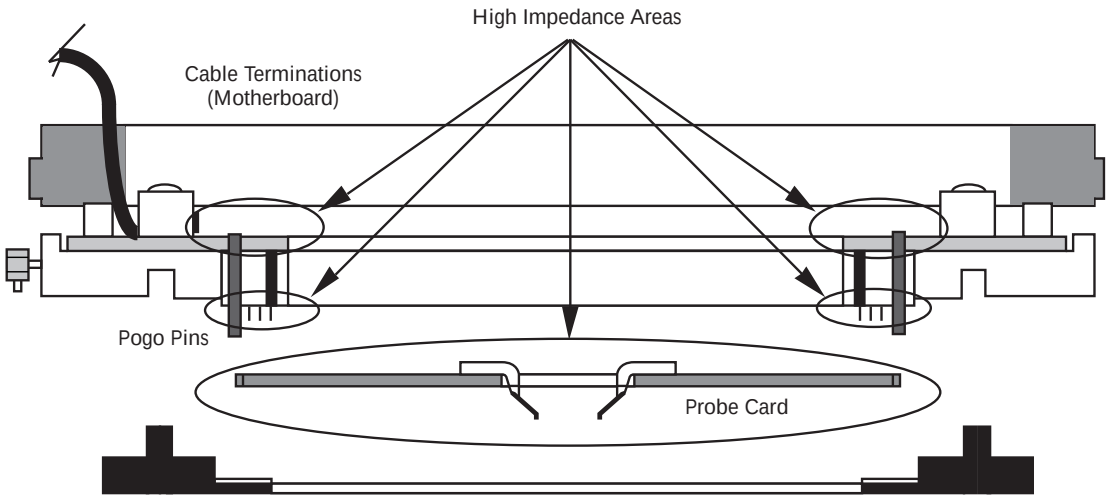

Figure 3-1
High impedance areas

3.3 General installation considerations

3.3.1 Overview

The mechanical architecture of the probe card adapter makes it possible to install the probe card adapter in a wide variety of probers. In general, the architecture consists of a mother board (Figure 2-1) suspended from the prober ring. Spacers inserted between the mother board and prober ring connect the two assemblies. The length of the spacers determines the overall stack height of the probe card assembly. Modification of the mother board assembly is not required when changing the stack height or when replacing the prober ring. The ring insert diameter is changed by replacing the prober ring. The following is a list of the different probers supported by the Model 9139A-PCA Prober Card Adapter.

- Alessi
- Electroglas 1034
- Electroglas 2000 Series (EG2001 and EG2010)
- Electroglas 3000 Series (EG3001 and EG3010)
- Electroglas 4060
- Electroglas 4080
- Electroglas 4085
- KLA 1007
- KLA 1220
- KLA/TEL P-8
- Pacific Western PW2
- Pacific Western PW3
- TAC PR8100
- Ultraprecision 680
- Ultraprecision 880
- Karl Suss
- TSK A-PM-90A

3.3.2 Safety

Operator safety from hazardous voltages depends on proper installation. After installation but before energizing the unit, make sure all prober safety shields are properly in place (refer to the manufacturer of your specific prober for prober safety shield information). The light shield contains components to allow for the installation of an interlock switch (such as that provided with a Keithley S500 Series Test System). See Figure 3-2.

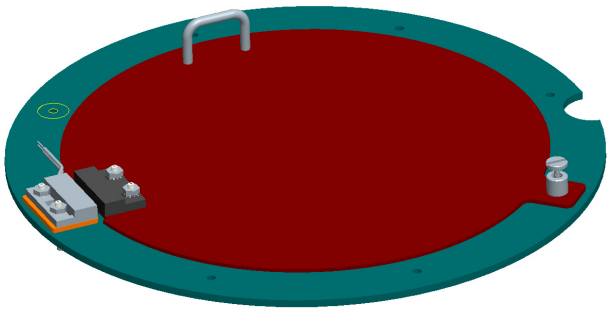

Figure 3-2
PCA light shield

WARNING

Do not operate the system until it is properly installed and all prober safety shields and interlocks are in place. Failure to have the complete system properly installed with all safety shields in place could result in personal injury or death.

3.3.3 Stack height

The height from the prober's mounting seat to the surface of the chuck (stack height) is a basic installation consideration (Figure 3-3). This stack height must equal the stack height of the probe card adapter. The stack height of the Keithley probe card adapter can be 1.330 inches (3.378 cm) or 1.492 inches (3.790 cm) depending on the type of prober and on the requirements for cable routing. Refer to Appendix C for prober specific stack height requirements. Installation may require installing mounting hardware onto the prober to insure that the prober stack height is the same as the probe card adapter stack height. See paragraph 3.4.

3.3.4 Cable routing

Cable routing is an important installation consideration. DUT cables can be routed above or below the top plate of the prober. For cable routing above the top plate, the DUT cables exit vertically from the probe card adapter. For cable routing below the top plate, the DUT cables exit horizontally from the probe card adapter.

The DUT cables are routed under the prober ring (of the probe card adapter). In addition, the DUT cables on some probers may exit from the left, right, or from the back of the prober. The cable exit you use depends on the type of prober and how the prober is oriented next to the system. Regardless of how the DUT cables exit from the prober, all the DUT cables must be the same length. A uniform cable length provides uniform electrical characteristics (capacitance and inductance) of the cables. This is important when performing capacitance measurements, or when measuring low level currents. (paragraph 3.4 contains important information about installing DUT cables.)

3.3.5 Probe card adapter configuration

Confirm that your probe card adapter assembly was configured properly at the factory. Included with your probe card adapter is a copy of your completed Probe Card Adapter Order Guide and a site specific drawing of your probe card adapter.

Confirm that the probe card adapter and the drawing match your requirements as listed on the order guide. Check the following items:

- Check the DUT cables' interconnecting plug(s). Make sure they are the correct type for your system.
- Check that there are the correct number of DUT pins (count the number of cables connected to the mother board).
- Inspect the installation hardware. This hardware is specific to your prober.
- Check DUT cable routing. Make sure that DUT cables are assembled correctly to the probe card adapter. This

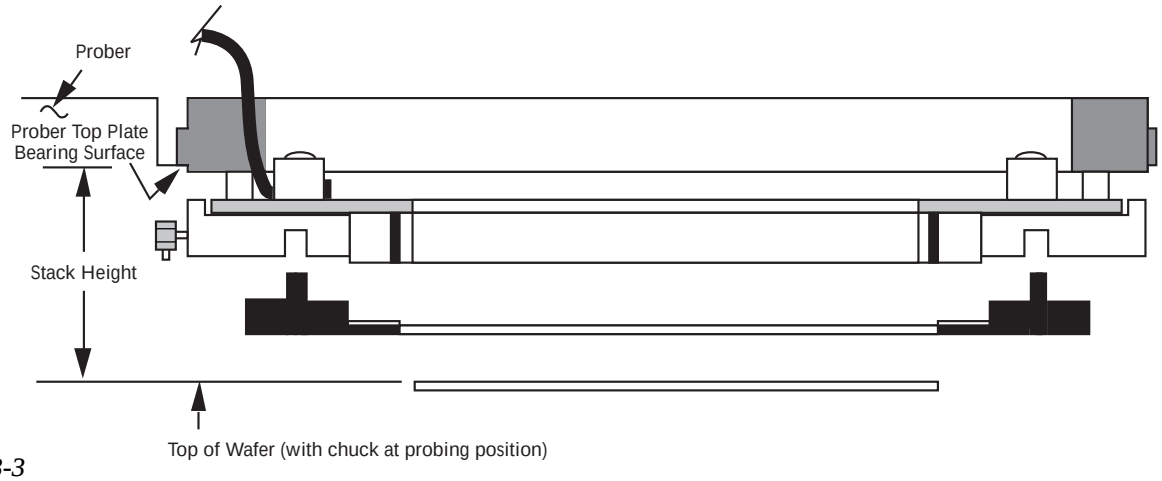

Figure 3-3
Stack height

allows the DUT cables to exit properly from prober after the probe card adapter is installed.

3.3.6 Light shield and microscope clearance

Check the light shield and microscope clearance. Most microscopes are located far enough above the probe card assembly that they do not present clearance problems when the light shield cover is installed. Some microscopes may protrude into the probe ring assembly to the area below the shield plate. This presents clearance problems. If the microscope is mounted on a pivoted arm, move the microscope aside and then install the light shield.

3.4 Installation procedure

WARNING

An installed probe card may contain lethal voltages when a test is in operation. Reset the test equipment to place the PCA (probe card adapter) in a safe state.

Failure to reset the test equipment may cause injury or death due to electrical shock.

Use the following procedure to install your Model 9139A-PCA Probe Card Adapter.

1. Unpack and inspect Model 9139A-PCA. (See paragraph 3.2 for special handling precautions.)
2. Install the probe card adapter in your prober.

   The hardware supplied with your probe card adapter assembly varies depending on the type of prober you have. Refer to paragraph 3.3.1 for a list of supported probers.

   Appendix C details the specific requirements for a number of standard probers. In some instances, the prober may be modified by the supplier for a particular application. If this is the case, contact Keithley for additional information on prober requirements and available options for the Model 9139A-PCA Probe Card Adapter.
3. Route 1.9 cm O.D. vacuum hose (provided) to probe card adapter out of the way of any moving parts of your prober. Make sure the hose remains clear of any pinch points that could cut off or restrict flow through the vacuum hose. The customer supplies all connections and hardware associated with vacuum hosing, in addition to the vacuum source.

   Install PCA to vacuum control box hose.

   - Route a section of vacuum hose from the PCA (probe card adapter) through the “TO PCA” grommet (on vacuum control box).
   - Connect the vacuum control box end of the hose to valve PF-1 (Figure 3-4) and the other end of the hose to the PCA.

   Install vacuum supply hose.

   - Route the vacuum supply hose from the vacuum source through the “VACUUM IN” grommet (on vacuum control box).
   - Connect the vacuum control box end of the hose to check valve PF-5 (Figure 3-4). Make sure vacuum supply is at least 50.8 cm Hg.

   Vent the vacuum control box to atmosphere (no connection required).
4. Making sure all power has been removed from the system, connect cables.
   - Connect the DUT cables between the probe card assembly and the matrix pin cards of the Parametric Test system. Route the cables to avoid sources of electromagnetic fields. Avoid routing cables near sources of vibration or any other mechanical disturbance.
   - Confirm that moving parts of the prober do not contact the cables.

Information regarding the location of connections within your system is found in the configuration drawings for your system. The User's Manual(s) for your systems contains additional information and can be referenced if required.

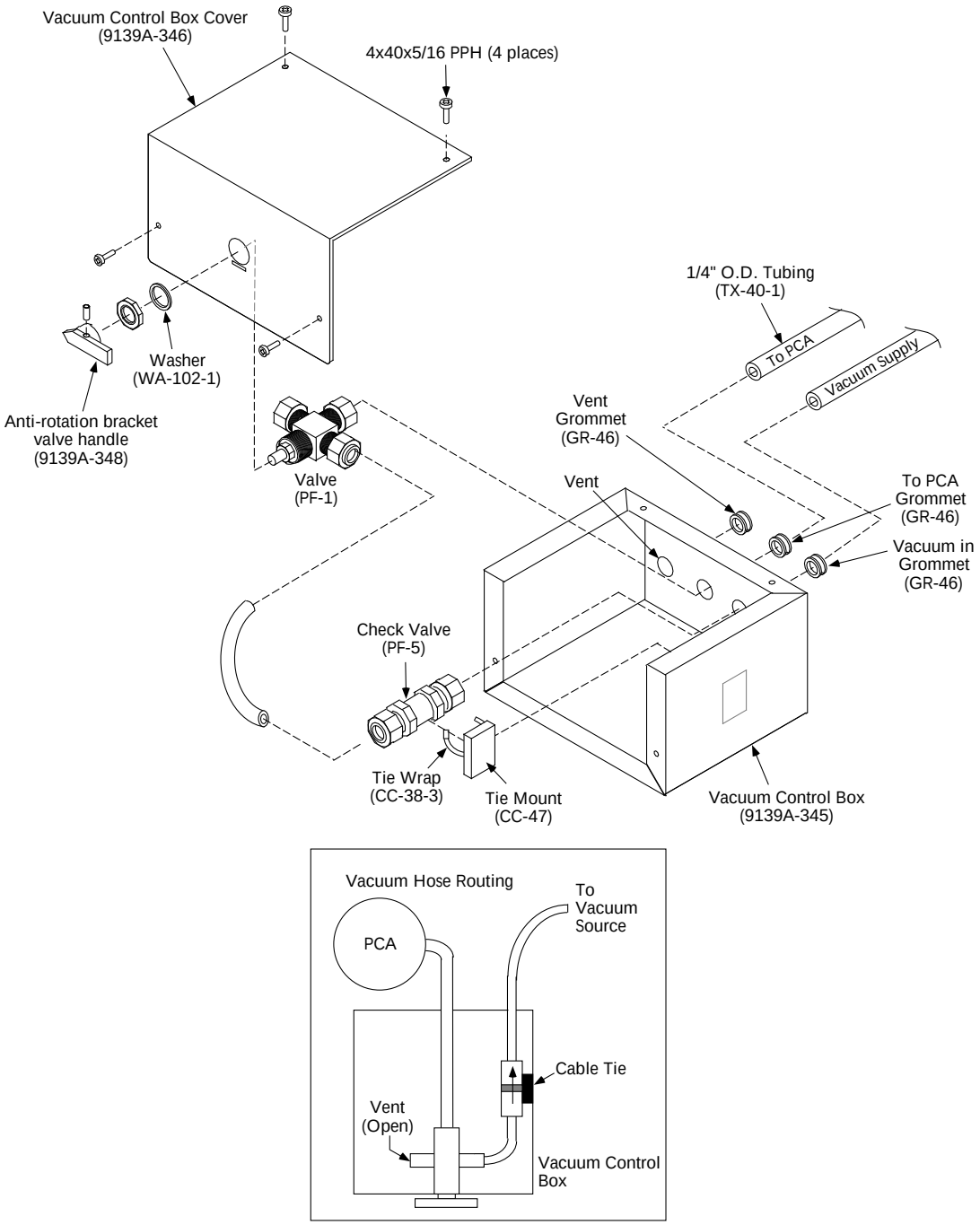

Figure 3-4
Vacuum control box

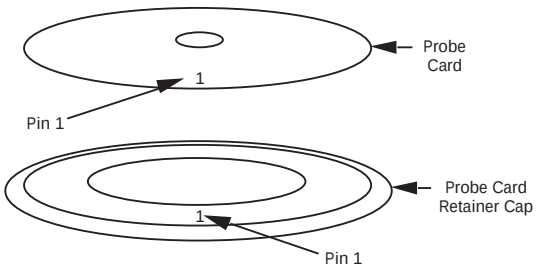

Figure 3-5
Probe card and probe card retainer cap

5. Install the probe card.
   - Turn vacuum control box valve to load/operate position.
   - Line up probe card pin 1 with pin 1 indicator on the retainer cap (Figure 3-5).
   - Insert probe card into probe card retainer cap.

NOTE

Two alignment pins and holes are provided along the perimeter of the probe card. These holes and pins provide for proper orientation of the probe card during installation.

   - Align pin 1 of the probe card with pin 1 of the mother board.
   - Use alignment marking on edge of probe card retainer cap and match to same markings of mother board support ring. Attach the retainer cap to the mother board ring. Make sure latches secure the probe ring (retainer cap will click into place).
6. Perform probe card continuity test (S400 Series System) to check Kelvin connections from the system matrix to the probe card adapter (refer to paragraph 3.7).

3.5 Probe card removal procedure

WARNING

An installed probe card may contain lethal voltages when a test is in operation. Reset the test equipment to place the PCA (probe card adapter) in a safe state.

Failure to reset the test equipment may cause injury or death due to electrical shock.

1. Run the probe card continuity test program (refer to paragraph 3.7).
2. Turn vacuum control box valve to the unload position.
3. Release the probe card retainer cap latches.
4. Carefully remove probe card and retainer cap from probe card adapter.

3.6 Performance verification

A matrix test is run as part of system diagnostics and requires a blank (unpopulated) probe card. Do not run a matrix test after installing each probe card. Run a Matrix Test after the probe card adapter installation to check for leakage, open connections, or shorted connections.

WARNING

During leakage tests, high voltages are present on the probe card adapter.

NOTE

It is necessary to install a blank probe card in the probe card assembly to run diagnostics (provided).

A blank probe card is supplied with the probe card adapter. This blank probe card must be retained by the customer. The blank probe card's clean surface provides a known, low leakage test environment. The unmodified Kelvin connections assure accurate continuity tests.

Handling and storage of the blank probe card is important. To permit accurate leakage tests, the probe card must remain unpopulated. The probe card must be stored in a protective container, in a clean, low humidity environment. Handling is important (see paragraph 3.2). When installing this card, handle card by the edges and do not touch surface of probe card.

The following list describes the programs to verify performance. For further information about running diagnostics, refer to the software and/or diagnostics manual for your system.

Performance Verification Using S530 Diagnotics

Run the Matrix Tests from S530 diagnostics to verify probe card adapter performance.

3.7 Options

3.7.1 Build plate and planarization fixture

A build plate and planarization fixture is available through Cerprobe. This fixture permits you to mount and adjust probes on the probe card. The fixture accepts the Keithley probe card. It interfaces to the Rucker & Kolls build station #300X and Planarization station #425.

The build plate and planarization fixture is purchased through one of the Cerprobe offices listed in Appendix B.

3.7.2 Close proximity load board

The Close Proximity Load Board is an option used when external components are required at DUT pins. This option is covered in detail in Section 4.

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4

Close Proximity Load Board

4.1 Introduction

This section contains information about the optional close proximity load board.

4.2 Close proximity load board

The close proximity load board is used when external components are required at the DUT pins. The load board is not required for most applications.

The load board consists of an unassembled PC board and a set of interconnecting pins and sockets (Hypertac pins). You assemble the load board and locate the Hypertac pins where external connections are required. The Hypertac pins and sockets should only be connected to probe pins where exter-

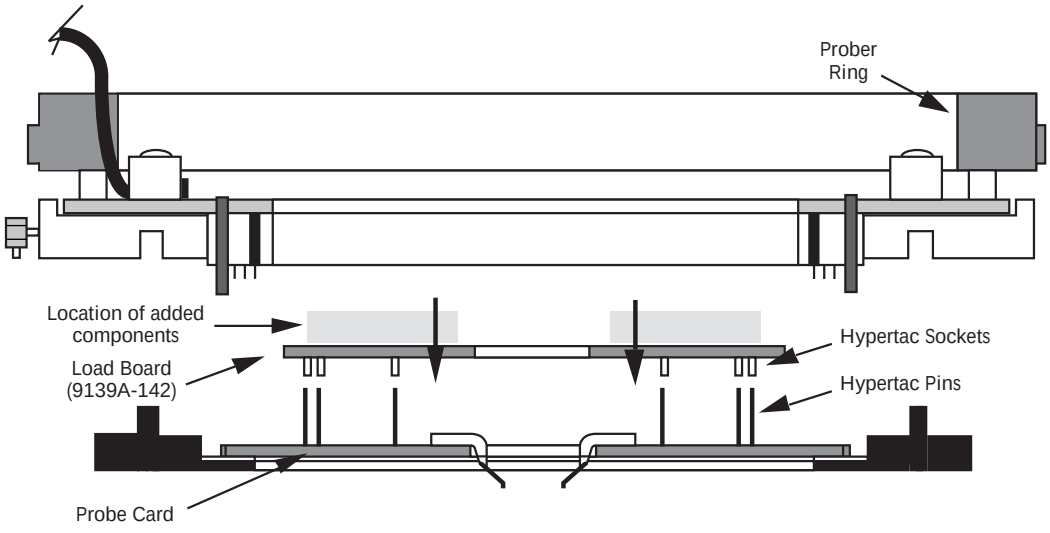

Figure 4-1
Probe card assembly – cross sectional view

nal connections are required. System specifications cannot be maintained on pins that are connected to the close proximity load board.

Figure 4-1 shows a cross section of the probe card assembly. The load board is mounted directly above the probe needles. It is held in place by the Hypertac pins.

4.3 Installing Hypertac pins

Procedure

To connect the load board to the probe card, use the following procedure:

1. Cut the source and measure traces on probe card pins where external components are required (Figure 4-2).

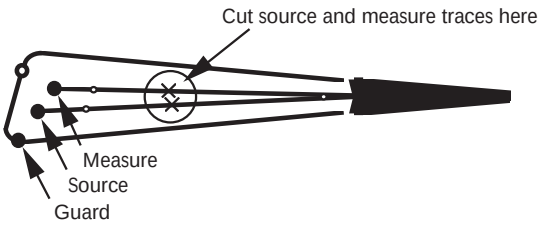

Figure 4-2
Source and measure traces

CAUTION

The source and measure signals must be connected together on the load board. Failure to do so may cause inaccurate readings and/or improper guarding.

2. Pre-assemble the Hypertac pins (Figure 4-3). Mate the pairs of pins.
3. Insert the mated pins and sockets into holes located on the probe card. Orient the mated pair so that the long pin is inserted into the probe card. Install three mated pins and sockets (Figure 4-4) for each DUT pin that requires connections to the load board.

   For applications requiring low capacitance and fast settling times, plan connections so that a minimum quantity of connections are required to the load board.

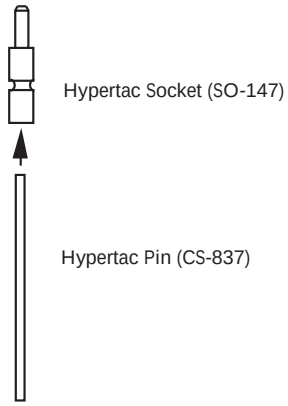

Figure 4-3
Hypertac pin assembly

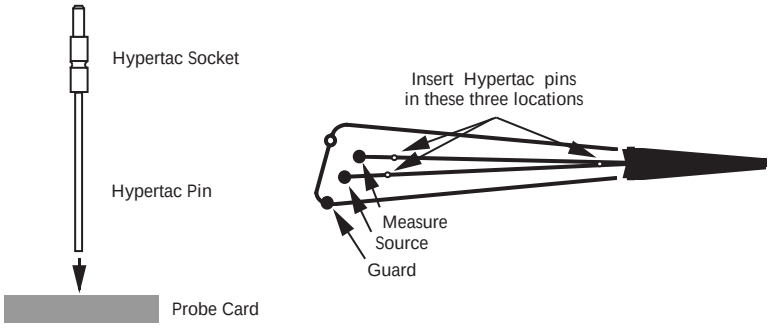

Figure 4-4
Hypertac pin installation

4. Place the load board on the sockets and line up so that all the sockets are seated in the load board (Figure 4-5).
5. Solder the socket to the load board. DO NOT SOLDER THE HYPERTAC PINS TO THE PROBE CARD (Figure 4-6).

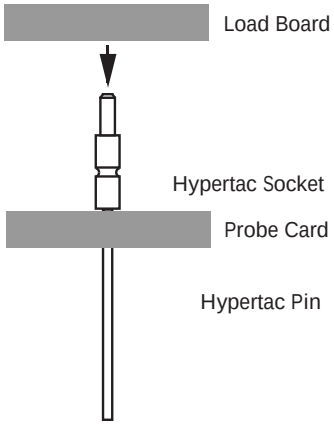

Figure 4-5
Seating Hypertac sockets in load board

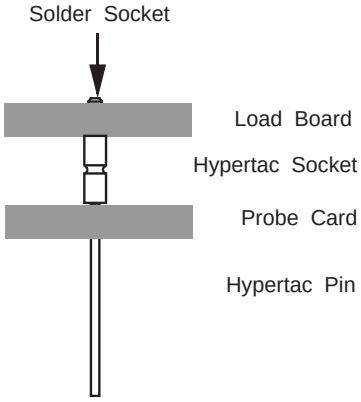

Figure 4-6
Soldering Hypertac sockets to load board

6. Insert a spacer between the load board and the probe card (Figure 4-7). Pull boards far enough to insert a spacer. Do not pull boards apart. Spacing between the boards should allow approximately 1/16” of the Hypertac pin to protrude through holes on the probe card.
7. Turn the probe card / load board assembly over so that the probe card faces up. Solder the Hypertac pins to the probe card (Figure 4-8).

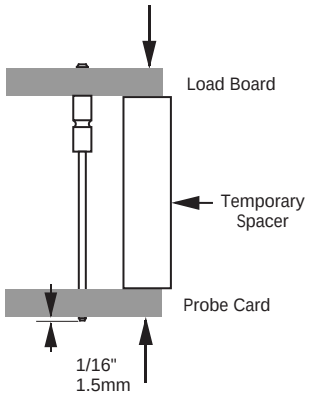

Figure 4-7
Temporary spacer installation

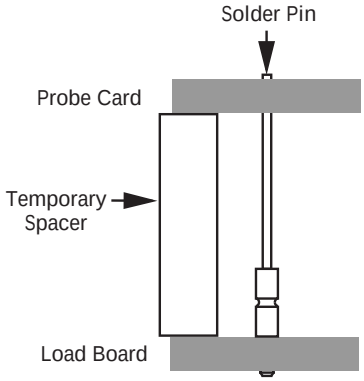

Figure 4-8
Soldering Hypertac pins

CAUTION

When soldering pins, avoid excessive heat on the foils. Excessive heat could cause breakdown of the chemical structure of the board material and could cause leakage problems.

8. When all components are mounted, clean the load board and probe card with an HCFC to remove all solder flux and contamination.

CAUTION

If the probe card adapter is used to perform low current measurements, proper cleaning is required. See paragraph 5.5 for additional information.

4.4 Installing components on load board

The load board has a grid pattern of holes spaced on 0.1 inch centers. Components are secured by soldering the leads into the plated through holes. Interconnections are made by soldering wires between the components. Connections to the source and measure conductors are made by soldering wires to holes located adjacent to where the source and measure Hypertac pins are soldered to the load board. See Figure 4-9.

NOTE

Source and measure conductors must be connected together on the load board. Connections to the probe pin are made by soldering a wire to the hole located adjacent to where the Hypertac pin is soldered to the load board.

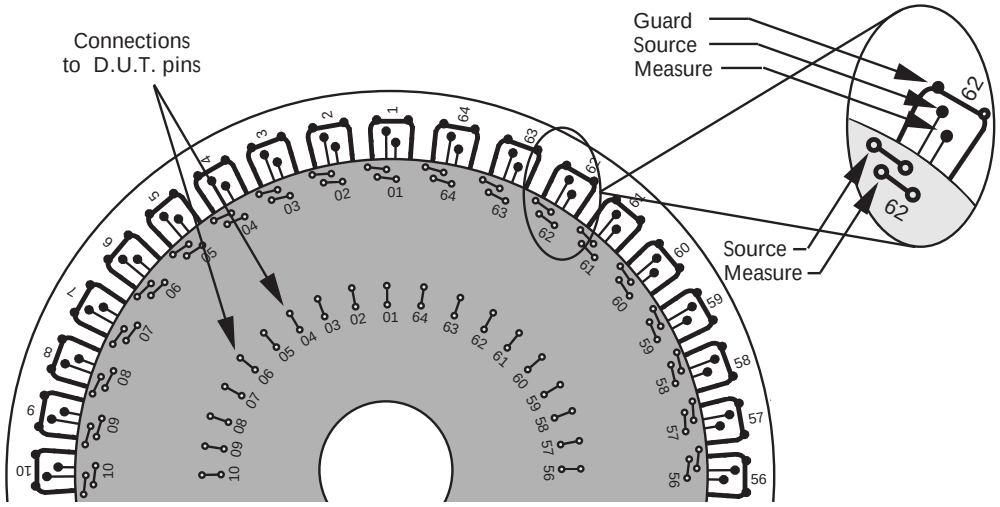

Figure 4-9
Locations of connections on probe card

4.5 Connecting ground to load board

If the components mounted on the load board require a ground connection, ground the load board. To ground the load board, either connect the load board to an external ground or ground to the mother board.

Note

A plug can be soldered to the load board end of the ground wire allowing the ground wire to be disconnected from the load board (if required).

External ground

Connect a ground wire to the load board (either by soldering or by soldering a plug to the end of the wire). Route the ground wire out of the top of the prober to an external ground.

Ground to mother board

Connect a ground wire to the load board (either by soldering to the load board or by soldering a plug to the end of the wire). Connect the ground wire to the mother board at one of the ground sockets for the DUT cables (the outer row of sockets).

4.6 Connecting power supply and control cables to load board

Connections to external power supplies and connections to digital control signals can be routed from the load board, out of the top of the prober.

4.7 Installing and removing the load board

To simplify installation, each pin is numbered on the probe card and on the load board. When assembling the two boards, confirm that the pin numbers match. The probe card is keyed and therefore will align with the correct pogo pins on the mother board.

To install the load board, follow these steps:

1. Orient the load board so that pin 1 of the load board aligns with pin 1 of the probe card.
2. Plug the load board into the Hypertac pins located on the probe card.
3. Install the support ring, probe card and load board assembly into the probe card adapter. See paragraph 3.4.

5 Maintenance

5.1 Introduction

This section describes how to perform maintenance while maintaining the high performance characteristics of the probe card adapter.

A minimum amount of maintenance is required for the mother board and the DUT cables. However when maintenance is required, it is important to perform maintenance operations correctly. Maintenance items, such as replacing cables, can have a significant impact on the probe card adapter's performance. When performing maintenance, lubricate all o-rings using Vacuum Goop (from Swagelok™). Make sure to use adequate Vacuum Goop for lubrication, but do not over lubricate o-rings.

For maintenance of the probe pins, refer to documentation provided by the manufacturer of the probe pins.

WARNING

The system can source high voltages at current levels that can result in personal injury or death. Turn off power to system before performing any maintenance procedure.

5.2 Mechanical disassembly

Disassembly of the probe card adapter is required when replacing DUT cables or when maintenance is required to the mother board.

NOTE

When assembling the probe card adapter, use Vacuum Goop (from Swagelok) to coat all o-rings.

To disassemble the probe card adapter, use the following procedure:

WARNING

An installed probe card may contain lethal voltages when a test is in operation. Reset the test equipment to place the PCA (probe card adapter) in a safe state.

Failure to reset the test equipment may cause injury or death due to electrical shock.

NOTE

If time and space are available, it is possible to disassemble the probe card adapter without disconnecting the DUT cables.

1. Place the PCA in a safe state by resetting the test equipment.
2. Turn the vacuum control box valve to the unload position.
3. Disconnect vacuum hose from the probe card adapter.
4. Disconnect the DUT cables from your system

5. Remove the probe card adapter assembly from your prober.
6. Remove the light shield assembly. See Figure 2-1.
7. Remove the Allen head screws that secure the cable strain relief, for the cable being replaced or moved.
8. Remove the probe card from the probe card adapter assembly (paragraph 3.5).

5.3 Replacing plug-in type DUT cables

The DUT cables are pre-assembled with connector pins installed at the factory. Replacement cables with pre-assembled connector pins are available through your Keithley sales office. When you install the replacement cable, note that three sizes of connector pins are used on each DUT cable. The smallest connector pin is installed on the source and measure conductors. A larger size connector pin is installed on the guard conductor. The largest connector pin is installed on the outer shield (ground) conductor.

WARNING

An installed probe card may contain lethal voltages when a test is in operation. Reset the test equipment to place the PCA (probe card adapter) in a safe state.

Failure to reset the test equipment may cause injury or death due to electrical shock.

To replace a DUT cable, perform the following procedure:

1. Place the PCA in a safe state by resetting the test equipment.
2. Disassemble the probe card adapter assembly (refer to paragraph 5.2).
3. Insert connector pins of cable in sockets in mother board (see Figure 5-1).
4. Reassemble probe card adapter.

5.4 Moving DUT cable connections

WARNING

An installed probe card may contain lethal voltages when a test is in operation. Reset the test equipment to place the PCA (probe card adapter) in a safe state.

Failure to reset the test equipment may cause injury or death due to electrical shock.

Typically probe card pin #1 is connected to system pin #1, probe card pin #2 is connected to system pin #2, etc. If an application requires different connections, you can connect the probe card pins to other system pins.

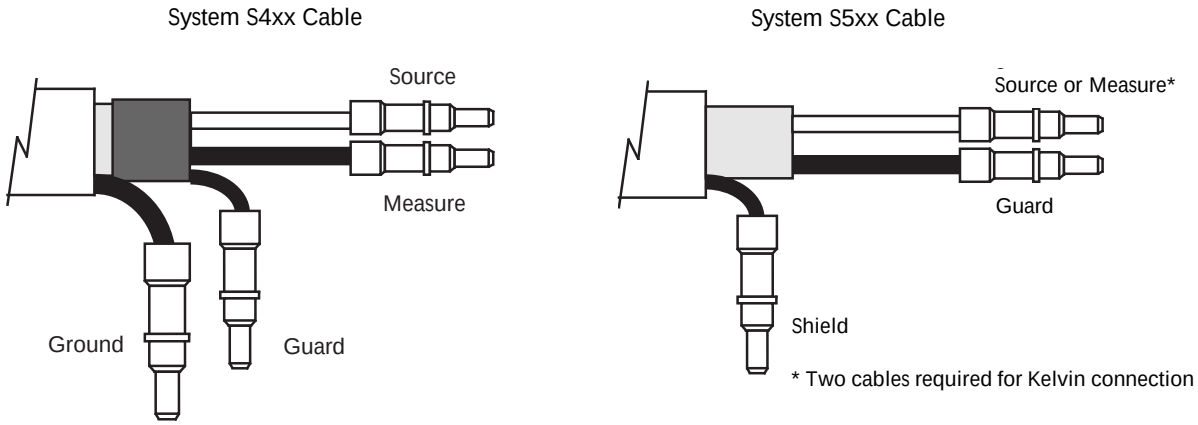

Figure 5-1
Replacing plug-in guarded type DUT cables

5.5 Cleaning

Cleaning is important to ensure accurate low current measurements. The cleaning process removes contamination that causes shunt resistance (leakage) between measurement paths.

Contamination can take many forms. Some sources of contamination are:

- Residue remaining after incomplete cleaning.
- Residue after using an improper or contaminated cleaning fluids.
- Residue from fingerprints. See paragraph 3.2.
- Flux from soldering.
- Condensation from room conditions which do not meet Keithley specifications.

Observe the following precautions when it is necessary to use solder on a circuit board:

- Use an OA-based (organic activated) flux, and take care not to spread the flux to other areas of the circuit board.
- Remove the flux from the work areas when the repair has been completed. Use pure water along with clean foam-tipped swabs or a clean soft brush to remove the flux.
- Once the flux has been removed, swab only the repaired area with methanol, then blow dry the board with dry nitrogen gas.
- After cleaning, the board should be allowed to dry in a 50°C low-humidity environment for several hours.

5.6 Replacing pogo pins

WARNING

An installed probe card may contain lethal voltages when a test is in operation. Reset the test equipment to place the PCA (probe card adapter) in a safe state.

Failure to reset the test equipment may cause injury or death due to electrical shock.

To replace a pogo pin, use the following procedure:

1. Reset the tester hardware.
2. Remove the probe card from the probe card adapter assembly. Refer to paragraph 3.5.
3. Remove the defective pogo pin. Grab the pin with a pair of needle-nose pliers. Pull the pin out of its socket.

CAUTION

The pogo pins are not symmetrical. Damage to the socket may occur if the pogo pins are inserted incorrectly.

4. Locate the rounded end of the replacement pogo pin (see Figure 5-2). Insert the rounded end of the pin into the socket. The double-chisel tip, located on the other end of the pogo pin, must protrude out of the socket. This end of pogo pin contacts a pad located on the probe card.
5. Re-install probe card.

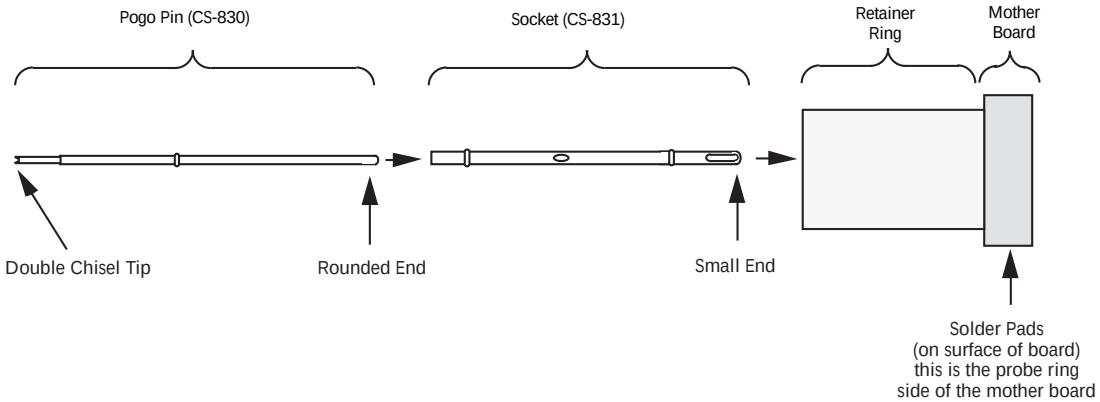

Figure 5-2
Orientation of pogo pin and socket

5.7 Replacing a pogo pin socket

If a pogo pin breaks off in a socket or if the pin becomes lodged in a socket, the pogo pin socket can be replaced. To replace a socket, use the following procedure:

WARNING

An installed probe card may contain lethal voltages when a test is in operation. Reset the test equipment to place the PCA (probe card adapter) in a safe state.

Failure to reset the test equipment may cause injury or death due to electrical shock.

1. Follow steps in paragraph 5.2 to disassemble the probe card adapter.
2. Locate the defective pogo pin/socket assembly.
3. Locate the pad where the defective socket is soldered to the mother board. This pad is on the probe ring side of the mother board (refer to Figure 2-1).
4. Unsolder the socket from the probe ring side (refer to Figure 2-1) of the mother board.

CAUTION

Do not apply excessive heat when desoldering socket. Excessive heat can melt the retention ring of the probe card adapter.

5. Remove the unsoldered pin. Push the end of the socket that protrudes through the mother board. Grab the other end of the socket with a pair of needle-nose pliers. Pull the socket out of its hole in the retention ring.
6. Remove residual solder from hole of solder pad.
7. Insert the small end of the replacement socket into the hole located in the retention ring (Figure 5-2). Slide the socket into the hole until the bottom of the socket is flush with the surface of the retention ring (pogo pin not installed in socket).
8. Confirm that the socket is installed properly (Figure 5-2). The small end of the socket protrudes through the hole on the mother board. The open end of the socket is flush with the surface of the retainer ring.
9. Solder the socket to the pad located on the mother board.
10. Install a pogo pin into the socket.
11. Clean the flux from the solder connection. See procedure in paragraph 5.5.
12. Re-install the probe card.

5.8 Replacing vacuum connection

The probe card adapter's vacuum connection can be replaced if damaged. Remove the vacuum connection. Make sure all old sealant is removed from threaded holes on probe card adapter. Lightly apply standard pipe sealant to new vacuum connection and install. Do not overtighten connection.

6
Replaceable Parts

6.1 Introduction

This section contains a list of replaceable parts for the Model 9139A-PCA.

6.2 Parts list

Probe card adapter

Table 6-1 contains the part numbers of probe card adapter models 9139A-PCA-01, 9139A-PCA-02, 9139A-PCA-04, and 9139A-PCA-05. Table 6-2 contains the part numbers of probe card adapter model 9139A-PCA-03.

Blank probe card

For a replacement blank (unpopulated) probe card, order Keithley part number 9139A-172.

6.3 Ordering information

To place an order, or to obtain information about replacement parts, contact your Keithley representative or the factory (see the front of this manual for addresses). When ordering parts, be sure to include the following information:

1. Probe card adapter model number 9139A
2. Adapter serial number
3. Part description and part number
4. Circuit designation, if applicable Keithley part number

6.4 Factory service

If the probe card adapter is to be returned to Keithley Instruments for repair, perform the following:

1. Obtain an RA from the Repair Department at Keithley. (They will also determine the warranty status of your probe card adapter.)
2. Carefully pack the probe card adapter in the original packing carton or the equivalent.
3. Write ATTENTION REPAIR DEPARTMENT on the shipping label.

Table 6-1
Models 9139A-PCA-01, 9139A-PCA-02, 9139A-PCA-04, and 9139A-PCA-05 parts list

Description	**Keithley part number**
.025 PIN	CS-835
4-40X1/4 PHILLIPS PAN HEAD SCREW (strap to standoff)	4-40X1/4PPH
4-40X3/4 SOCKET BUTTON HEAD (ring segment mounting, Figure 2-1)	4-40X3/4SOBTNH
6-32X1-1/4 SOCKET FLAT HEAD (mother board retainer mounting)	6-32X1-1/4SOFHS
6-32X3/4 PH PAN HD SCR (shield plate mounting)	6-32X3/4PPH
CAP, PROBE CARD RETAINER (Figure 2-1)	9139A-327
CLOSE PROXIMITY LOAD BOARD (Figure 4-1)	9139A-142
COVER LIGHT PROBE RING	9139-312
HANDLE, SHIELD	HH-37
INSULATOR, BLACK DECAL (Figure 2-1)	9139-313-01
INSULATOR, BLACK DECAL (Figure 2-1)	9139-313-02
O-RING, THERMOBONDED (use Swagelock Vacuuum Goop)	GA-32
O-RING, THERMOBONDED (use Swagelock Vacuuum Goop)	GA-33
PIN, CONTACT (Figure 4-3)	CS-837
PIN, CRIMP BARREL, .040	CS-836-1
PIN, CRIMP BARREL, .060	CS-836-2
PROBE CARD (Figure 2-1)	9139A-172
PROBE, POGO PIN (Figure 5-2)	CS-830
PROBE RING INSERT (Figure 2-1)	9139A-325A
RECEPTACLE, POGO PIN (Figure 5-2)	CS-831
RETAINER RING (Figure 2-1)	9139A-326
RING SEGMENT, CABLE CLAMP (strain relief for Models 9139A-PCA-01 and 9139A-PCA-02, Figure 2-1)	9139A-333-1
RING SEGMENT, CABLE CLAMP (strain relief for Models 9139A-PCA-04 and 9139A-PCA-05, Figure 2-1)	9139A-333-2
SHIELD PLATE, PROBE RING (Figure 2-1)	9139A-310
SOCKET, .018 PROBE RING CPLB (Figure 4-3)	SO-147
SPACER (MODELS 9139A-PCA-01 and 9139A-PCA-04)	9139A-334-2
SPACER (MODELS 9139A-PCA-02 and 9139A-PCA-05)	9139A-334-1
STANDOFF, MOUNTING BLOCK	9139-315
STRAP, PROBE RING SHIELD	9139-314
10 AWG PVC GREEN/YELLOW	SC-99-5
4-40X3/8 SOCKET BUTTON HEAD (mother board to spring contact retainer)	4-40X3/8SOBTNH
LUG	LU-113
LUG	LU-99-6
MOTHER BOARD (Figure 2-1)	9139A-102
RETAINER, SPRING CONTACT (Figure 2-1)	9139A-331
SOCKET, .025	SO-146-1
SOCKET, .040	SO-146-2
SOCKET, .060	SO-146-3
WASHER (mother board to spring contact retainer)	WA-102-2

Table 6-2
Model 9139A-PCA-03 parts list

Description	Keithley part number
.025 PIN	CS-835
4-40X3/4 SOCKET BUTTON HEAD	4-40X3/4SOBTNH
4-40X3/8 SOCKET BUTTON HEAD (mother board to spring contact retainer, Figure 2-1)	4-40X3/8SOBTNH
CLOSE PROXIMITY LOAD BOARD (Figure 4-1)	9139A-142
MOTHER BOARD	9139A-122
PIN, CRIMP BARREL, .040	CS-836-1
PIN, CRIMP BARREL, .060	CS-836-2
PIN, CONTACT (Figure 4-3)	CS-837
PROBE CARD (Figure 2-1)	9139A-172
PROBE, POGO PIN (Figure 5-2)	CS-830
RECEPTACLE, POGO PIN (Figure 5-2)	CS-831
RETAINER, SPRING CONTACT (Figure 2-1)	9139A-331
RING SEGMENT, CABLE CLAMP (Figure 2-1)	9139A-333-1
SOCKET, .018 PROBE RING CPLB (Figure 4-3)	SO-147
SOCKET, .025	SO-146-1
SOCKET, .040	SO-146-2
SOCKET, .060	SO-146-3
WASHER (mother board to spring contact retainer)	WA-102-2

Probe card retainer/cam assembly

Qty.	Description	Keithley part number
1	Retainer Ring (Figure 2-1)	9139A-326
1	Cap, Probe Card Retainer (Figure 2-1)	9139A-327
2	Cam, Retainer	9139A-328
2	Pivot Pin Cam	9139A-329
2	Torsion Spring	9139A-330
1	Ring, Insulator	9139A-332
2	Dowel Pin	9139A-335
2	Dowel Pin Cam	9139A-336
2	Truarc Ring, #45133-14H	FA-233-2
1	O-Ring, Thermobonded	GA-32
1	O-Ring, Thermobonded	GA-33
1	Adapter, Right Angle (Figure 2-1)	PF-6
1	4-40 X ¼ PFHUC (handle mount)	4-40X¼FHUC

Miscellaneous vacuum control box parts

Qty.	Description	Keithley part number
4	Nylon Tie Wrap (Figure 3-3)	CC-38-3
4	Tie Mount (Figure 3-3)	CC-47
1	Static Shielding Bag	PO-13-3
1	Tygon Tubing (order by length) (Figure 3-3)	TX-40-1

A
Glossary

Chuck The metal platform that holds the wafer during probing.

Close proximity load board (load board) This is an optional printed circuit board that mounts directly above the probe needles. It is used to connect resistors, capacitors, etc. to the probe needles. The load board is used when additional components must be located as close as possible to the probe needles.

Head plate (top plate) (ring carrier) The upper surface of the prober that holds the probe card adapter.

Hypertac™ pin A type of connector pin used where low contact resistance, long life and low insertion forces are required.

Interconnect pins Pins located between the probe card end of the DUT cable and the mother board.

Mother board assembly The printed circuit board where the DUT cables and pogo pins are soldered.

Mother board support ring The metal ring located under the mother board.

Pogo pins The spring loaded contacts that are located between the mother board and the probe card.

Probe blade A fine wire or contact assembly that provides the electrical connection between the die on the wafer and the probe card.

Probe card This is the printed circuit board where the probe blades are mounted.

Probe card adapter The complete probe assembly. This includes the mother board assembly, DUT cables, probe card, and prober specific hardware. The probe card adapter is mounted to the head plate.

Probe card support ring The retaining ring for the probe card. This is mounted on the bottom side of the Probe Card Adapter and holds the probe card.

Probe needles The contacts located between the probe card and the pads on the wafer.

Prober specific hardware Any special hardware that is required to install the probe card adapter into a specific prober.

Ring carrier Supports the mother board assembly (prober specific).

Stack height (of prober) The distance between the surface the probe ring mounts on, and the surface of the chuck.

Stack height (of probe card adapter) This is the distance between the surface where the probe ring rests against the top plate and the tips of the probe blades.

B

Standard Prober Requirements

Alessi Prober

Stack height:	3.378cm (1.330 in.)
Cable Routing:	Top (only)
Cable exit:	Any direction
Ring insert diameter:	24.764cm (9.75 in.)
Customer supplied parts: (from Alessi)	Adapter ring

Electroglas 1034 Prober

Stack height:	3.789cm (1.492 in.)
Cable Routing:	Over top plate of prober (only)
Ring insert diameter:	24.764cm (9.75 in.)

Electroglas 2000 Series (EG2001 and EG2010) Prober

Stack height:	3.789cm (1.492 in.)
Cable Routing:	Over top plate of prober (only)
Ring insert diameter:	24.764cm (9.75 in.)

Electroglas 3000 Series (EG3001 and EG3010) Prober

Stack height:	3.789cm (1.492 in.)
Cable Routing:	Over top plate of prober (only)
Ring insert diameter:	24.764cm (9.75 in.)

Electroglas 4060 Prober

Stack height:	3.789cm (1.492 in.)
Cable Routing:	Over top plate of prober (only)
Ring insert diameter:	24.764cm (9.75 in.)
Adapter ring part number:	254635-001

Electroglas 4080 Prober

Stack height:	3.789cm (1.492 in.)
Cable Routing:	Over top plate of prober (only)
Ring insert diameter:	24.764cm (9.75 in.)
Adapter ring part number	254635-001

Electroglas 4085 Prober

Stack height:	3.789cm (1.492 in.)
Cable Routing:	Over top plate of prober (only)
Ring insert diameter:	24.764cm (9.75 in.)

KLA 1007/1220 Prober

Stack height:	3.378cm (1.330 in.)
Cable Routing:	Top (only)
Cable exit:	Any direction except from front of prober
Ring insert diameter:	24.764cm (9.75 in.)
Special installation notes:	1. Move vacuum hose to permit installation of probe card adapter. 2. Move LED sensor to permit installation of probe card adapter.
Customer supplied parts (from KLA):	1. Standard ring insert adapter P/N 780-900935-00 2. HF prober ring insert adapter P/N 780-910804-00.

TEL P-8/P-8XL

Stack height:	3.378cm (1.330 in.) standard headplate - order 9139A-PCA-03 for SACC P-8 Model (auto probe card changer)
Cable Routing:	Top (only)
Cable exit:	Any direction except from front of prober.
Ring insert diameter:	24.764 cm (9.75 in.)
Customer supplied parts: (from KLA/TEL):	Ring insert adapter P/N U261-Z30003-XX

Pacific Western PW2 Prober

Stack height:	3.789cm (1.492 in.)
Cable Routing:	From top or bottom
Cable exit:	Any direction
Ring insert diameter:	24.447cm (9.625in.)
Special item required (from Keithley):	Keithley probe ring insert P/N 9139A-351 (501112)

NOTE

Contact Keithley Instruments if your prober is not shown.

Pacific Western PW3 Prober

Stack height:	3.789cm (1.492 in.)
Cable Routing:	From top or bottom
Cable exit:	Any direction
Ring insert diameter:	24.447cm (9.625 in.)
Special items required (from Pacific Western):	1. Extended travel option (to allow for a 6" probe card) 2. Cylindrical card adapter with no cutouts.
(from Keithley):	3. Keithley probe ring insert P/N 9139A-351 (501112)

TAC PR8100 Prober

Stack height:	3.378cm (1.492 in.)
Cable Routing:	Top (only)
Cable exit:	Any direction
Ring insert diameter:	24.764cm (9.75 in.)
Special item required:	Special adapter ring from Teledyne TAC

Ultraprecision 680 Prober

Stack height:	3.789cm (1.492 in.)
Cable Routing:	From top or bottom
Cable exit:	Any direction
Ring insert diameter:	24.764cm (9.75 in.)

Ultraprecision 880 Prober

Stack height:	3.789cm (1.492 in.)
Cable Routing:	From top or bottom
Cable exit:	Any direction
Ring insert diameter:	24.764cm (9.75 in.)

Karl Suss Prober

Consult factory for specifications.

TSK A-PM-90A Prober

Stack height:	3.789cm (1.492 in.)
Cable routing:	Top (only)
Cable exit:	Rear and left (only)
Ring insert diameter:	24.764 cm (9.75 in.)
Customer supplied parts (from TSK):	Ring insert P/N FM01275-D001-00

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